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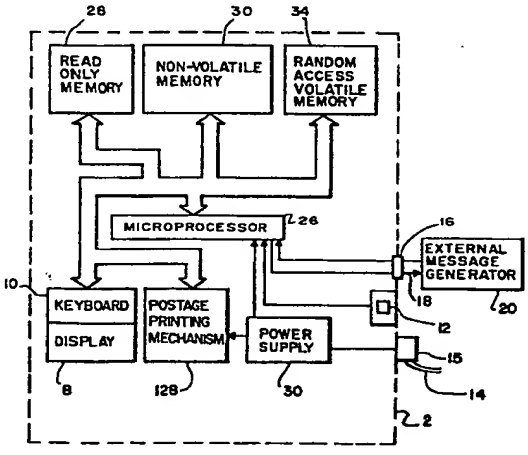
(54) **Postage meter having non-volatile memory for containing a serial number.**

(57) An electronic postage meter (2) has a non-volatile memory (30) arranged to provide a field to accommodate a postage meter serial number. The serial number may be entered into the meter from a message generator (20) at the end of the manufacturing process after the meter has been assembled and the components tested. The postage meter (2) includes a routine programmed into a read only memory (28) which is intended to be used only once during the life of the meter's non-volatile memory (30). The routine requires the check of a non-volatile memory location which is set once the routine has been successfully completed. The setting of this bit prevents reentry into the one time program. The program can be reused until the bit is set. The bit is set by comparision of the data included in a received message with the value of the data contained in non-volatile memory. If the comparison is true, the bit is set.



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Postage Meter Having Non-Volatile Memory for containing a Serial Number

The present invention relates to meters, such as electronic postage meters having a non-volatile memory adapted to contain therein a serial number for the meter.

Electronic meter systems have been developed, as for example the systems disclosed in U.S. Patent No. 3 978 457 for MICROCOMPUTERIZED ELECTRONIC POSTAGE METER SYSTEM, in U.S. Patent No. 3 938 095 for COMPUTER RESPONSIVE POSTAGE METER, in U.S. Patent No. 4 301 507 for ELECTRONIC POSTAGE

METER HAVING PLURAL COMPUTING SYSTEMS and in European Patent Application, Publication No. 0 019 515 for ELECTRONIC POSTAGE METER HAVING IMPROVED SECURITY AND FAULT TOLERANCE FEATURES.

Each of the electronic postage meters disclosed in the above-identified applications and patents includes a non-volatile memory for storing critical information when power is not applied to the meter. Various types of accounting information may be stored in the meter's non-volatile memory. This information includes, for example, the amount of postage remaining in the meter for subsequent printing and the total amount of postage printed by the meter. Other types of accounting or operating data may also be stored in the non-volatile memory. The function served by the non-volatile memory circuits have replaced and enhanced the functions of the mechanical accounting registers or wheels utilized in previous mechanical type postage meters.

It has been recognized that during the assembly of electronic postage meters it may be desirable to enter the serial number into the non-volatile memory of the meter upon completion of the assembly operation. It is found that this can be done in electronic postage meters. In one such arrangement, a non-volatile memory chip number is entered into the non-volatile memory and is used during the assembly of the meter. The meter itself, however, is assembled with the final serial number on the meter body still utilizing a non-volatile memory with a given chip number entered in the serial number field. When assembly and testing is completed, the final serial number is communicated to the meter. It is also noted that a flag bit can be set if the path to the serial number in the non-volatile memory is to

be closed off so that the data field in the non-volatile memory occupied by the serial number cannot be written into. That is, writing into non-volatile memory data field containing the serial number is prevented. Such a system is disclosed in U.S. Patent Application, Serial Number 238 331 filed February 26, 1981 for Alton B. Eckert, Jr. and Edward C. Duwel, and entitled "SYSTEM FOR ENTERING A POSTAGE METER SERIAL NUMBER INTO A NON-VOLATILE MEMORY FROM AN EXTERNAL CHANNEL AFTER ASSEMBLY OF THE METER."

An object of the invention is to provide a postage meter which enables changing of a serial number in one meter until it is finally determined that the entered serial number is correct. According to the invention, there is provided printing means for printing postage, a computing means coupled to said printing means for accounting for postage printed by said printing means, non-volatile memory means coupled to said computing means and a progam store coupled to said computing means and adapted to store programs to control the operation of said computing means, sais program store containing a program operable to cause said computing means to compare a serial number message including an operational indicator bit entered into the postage meter with a previously entered postage meter serial number and operable to cause said computing means to set a lock bit preventing reentry into said program if a comparision is obtained in the condition where an operational indicator bit in said entered serial number message is set to indicate a desire to utilize the entered serial number.

For a better understanding of the invention and to show how the same may be carried into effect, reference is now made to the drawings in which like reference numerals de-

signate similar elements in various views of a preferred embodiment of the invention, and in which:

Figure 1 is a perspective view of an electronic postage meter adapted to utilize the present invention;

Figure 2 is a block diagram showing one arrangement of the internal major components of an electronic postage meter embodying the present invention;

Figure 3 is a partial memory map of the non-volatile memory shown in Figure 2 depicting placement of the serial number and a one bit serial number lock indicator;

Figure 4 is a disgramatic representation of a serial number message including an operational indicator BCD bit digit;

Figure 5 is a table of codes helpful in understanding the present invention; and

Figure 6 is a flow chart of the firmware program of the read only memory shown in Fig. 2.

Reference is now made to Fig. 1. Fig. 1 is a perspective view of a postage meter adapted to utilize the present invention. An electronic postage meter 2 is removably secured to a postage meter base 4. In this arrangement, a slot 6 is provided between the postage meter 2 and the base 4 at the forward edge thereof, for receiving envelopes

or the like for the printing of postage thereon. The postage meter is provided with a display panel 8, preferably an electronic display device, as well as a control panel or keyboard 10.

The meter 2 includes a service mode switch 12. Power is applied to the meter 2 via a AC power line cord 14 when the meter power switch 15 is turned on. The meter also includes a communications port 16 which is connected by a communications cable 18 to an external message generator 20. The message generator is removable from the meter by detaching the cable 18 from the communications port 16. Communications between the meter 2 and the external message generator 20 may be in accordance with the serial communication echoplex technique described in U.S. Patent No. 4 301 507 for ELECTRONIC POSTAGE METER HAVING PLURAL COMPUTING SYSTEMS.

As will be explained in greater detail hereinafter, the operation of the keyboard 10 of the electronic postage meter 2 differs from that of the keyboard 22 of the external message generator 20. The external message generator keyboard 22, with its unique keys 24 can invoke a routine in a read only memory in the external message generator 20 to generate a message with a unique header and format suitable to invoke a particular function in the electronic postage meter 2. That is, the keyboard 22 of the external message generator 20 can cause a message to be generated by the external message generator and communicated over communications channel 18 to the meter to invoke a routine stored in the non-volatile memory of the electronic meter 2 which cannot be invoked by actuation of the meter keyboard 10.

Figure 2 which is a block diagram showing one arrangement of the internal major components of an electronic meter embodying the present invention. The electronic postage meter 2 is controlled by a microprocessor 26 operated under control of a series of programs stored in a read only memory 28. Connected to the microprocessor are the keyboard 8 and display 10 as well as a postage printing mechanism 28. The microprocessor accepts information entered via the keyboard or via the communications port 16 from an external message generator, such as the external message generator 20, over the communications channel 18. Critical accounting and other information is stored in a non-volatile memory 30. The non-volatile memory may be an MOS semiconductor type memory, a battery augmented CMOS memory, or other suitable non-volatile memory component. The function of the non-volatile memory 30 is to store critical postage meter data during those times when the power is not applied to the meter. This data may include, in addition to the serial number of the meter, information as to the amount of the descending register (the amount of postage available for printing), the value of the ascending register (the total amount of postage printed by the meter), and the value of the piece count register (the total number of cycles the meter has performed), as well as other types of data, such as service information, which are desired to be retained in the memory when no power is applied to the meter.

When the meter power switch 15 is turned on causing the power supply 30 internal to the meter to energize the microprocessor 26 and the postage printing mechanism 28, the information stored in the non-volatile memory 30 is transferred via the microprocessor to a volatile random

access memory 34. The volatile, random access memory 34 after power up contains an image of copy of the information stored in the non-volatile memory 30 prior to energization. During operation of the postage meter, the data in the volatile, random access memory 34 is modified. Accordingly, when postage is printed, the descending register will be decremented, the ascending register incremented and the piece counter register incremented. When the power switch 15 is turned off, the modified image, the current updated data in the volatile, random access memory 34 is transferred via the microprocessor back into the non-volatile memory 30. The data is transferred into a suitably prepared area of the non-volatile memory. Thus, the non-volatile memory 30 is updated during the power down cycle when the power switch 15 is turned off. A like transfer of information between the non-volatile memory 30 and the volatile, random access memory 34 also occurs when the service mode switch 12 is actuated.

Reference is now made to Figure 3. Contained in the non-volatile memory 30 of the meter are seven nibbles 36 which are reserved for the serial number. Also contained in non-volatile memory 30 is an additional bit position 38 which is reserved for the lock indicator. The placement of the serial number is shown by the indicators of the binary coded digit, where BCD 7 is the most significant digit of the serial number and BCD 1 is the least significant digit.

When the service mode of the meter is entered via an external message, the firmware logic of the meter causes the non-volatile memory 30 to be prepared to have new or modified service data written into the non-volatile memory. The service field contains the serial number location. It should

be recognized that when the present invention is utilized with electronic postage meters of the type shown in U.S. Patent No. 4 301 507 for ELECTRONIC POSTAGE METER HAVING PLURAL COMPUTING SYSTEMS, the service mode switch described therein, as well as in U.S. Patent No. 4 280 180 for ELECTRONIC POSTAGE METER HAVING FIELD SETTABLE CONTROL VALUES, is left in the operational mode as proposed to the service mode. This causes the external communications channel to remain operative. The entry into the service routine is achieved by the transmission of a service routine message from the external message generator 20.

It should be understood that for the purposes of the description of present invention, the meter is of the type wherein the information from non-volatile memory 30 is read during power up to the meter (when the meter power switch 15 is turned ON) and transferred back to non-volatile memory 30 during the change from the operational to the service mode of the meter (when the meter service switch 12 is moved from the operational to the service position). At all other times, a current copy of image of this information is in the volatile, random access memory 34 of the meter. Changes are made to the image of the information in the volatile random access memory 34. During the power down of the meter (when the meter power switch 15 is turned OFF) or mode change (service to operate or operate to service), the information in the volatile randon access memory 34 is written into the non-volatile memory 30.

Reference is now made to Figure 4. The enter serial number message consists of a one byte (eight bits) header or identifier 40, a formatbyte 42 and four data bytes 44 for a total of six bytes. Contained in the four daty bytes 44 are a BCD operational indicator 46 and seven binary coded

digits, two per byte, representing the serial number. Header 40, format 42 and data bytes 44 are as generally described in the aforementioned U.S. Patent No. 4 302 507. The header 40 provides identification of the unique message that is to follow, here, the fact that the message constitues the serial number. The format byte 42 contains two BCD digits indicating the number of data digits to follow and the placement of the decimal point within these digits. In the present case of the serial number, there is no decimal point, therefore, the decimal point position indicator will be shown as containing four one or a hex F in decimal point indicator position.

The operational indicator BCD digit 46 indicated to the meter, operating under the control of the firmware program contained in the read only memory 28, which operation (change the serial number of lock the serial number) is to be performed. A zero will indicate a desire to change the serial number and a one will indicate a desire to lock the serial number. Codes 2 HEX thru F HEX of the operational indicator are undefined and will cause the meter to return a procedural error message.

This is depicited in Figure 5 wherein a table of codes is shown for the operational indicator BCD digit. Only the first two codes 48 and 50 as previously noted will cause the meter to operate in accordance with the program routine to be described hereinafter. Utilization of any of the additional codes shown will cause the meter to return an error message. This error message is a procedural error message which disappears after a timed period or reinitialization of the meter as opposed to a fatal error message which will cause the meter to become inoperative for the remainder of the power on period or to lock up.

Procedural and fatal errors are described in pending U.S. Patent Application Serial No. 225 571 filed January 16, 1981 for ELECTRONIC POSTAL METER SYSTEM and assigned to Pitney Bowes Inc. and in U.S. Patent No. 4 251 874 for ELECTRONIC POSTAGE METER SYSTEM.

Referring now to Figure 6, after the meter has been placed in the service mode by an externally generated message (the external message) and with the service switch in the operational mode, the external message generator generates a serial number message. Upon receipt of the serial number message, the firmware program of the meter causes the meter to check the message for proper formatting and returns a procedural error message if the format is not acceptable. If the format is acceptable, the firmware program causes the meter to examine the condition of the lock bit which was stored in non-volatile memory 30. If this lock bit is set, the meter returns a procedural error message. If the lock bit is not set, the firmware program then causes the meter to examine the operational indicator hex digit 46 contained in the serial number message. If the operational indicator hex digit is a zero, the meter will change the serial number information in the volatile, randon access memory image to correspond to the serial number contained in the message. The meter will then return a status message to the external message generator. If the operational indicator bit is set to the hex digit 1, the firmware will cause the meter to compare the serial number data in the volatile randon access memory 34 with the serial number data contained in the message. If the comparision is positive, the meter will set the non-volatile memory lock bit in its image in the volatile, random access memory and return a status message to the external

message generator. All other conditions that are tested and failed will return a procedural error message and will not set the non-volatile memory lock bit in its image in the volatile, random access memory 34. Thus, the serial number message format includes an operational BCD digit as an operational indicator. If the serial number has been entered and the operational indicator set to zero, the serial number will be changed to the value contained in the data message. If the operational indicator is a one, the firmware will examine the serial number presently contained in non-volatile memory, and compare it with the value contained in the serial number message. If the result is favorable or true, the program will set the non-volatile memory lock bit thus preventing further access to this program.

The information containing the serial number or the serial number and lock bit contained in the data in the volatile, random access memory 34 is written into the non-volatile memory 30 either upon power down of the meter or a mode change. Under normal conditions, the external message generator 20 will send an exit service mode signal message to the meter. This message will cause the image in the volatile, random access memory 34 to be written into the non-volatile memory 30. After the procedure is completed and the external message generator 20 has been removed from the meter 2, the meter can be used to check the serial number and all other checks conducted during routine manufacturing shop checks.

Thus, by use of the invention, the serial number can if necessary be repeatedly entered, e.g. during production of the meter, until it is determined that the entered number is correct.

This allows adjustment in the case of erroneous key strokes and avoids problems of having meters fail at the final assembly point because of inadvertent errors which would require the entire meter to be disassembled to access the non-volatile memory in the meter.

A serial number may be entered into the meter at the end of the manufacturing process after the meter has been assembled and the components tested by actuation of a routine programmed into a read only memory within the meter. This routine is used only once during the life of the meter non-volatile memory. The routine requires the check of a non-volatile memory bit position which is set once the routine has been successfully completed. The setting of this bit prevents reentry into the one time program. The program can be reused until the bit is set. The bit is set by comparision of the data included in a received message with the value of data contained in memory. If the comparision is true, the bit is set. The format of the received message entered into the meter to enter the serial number and set the bit requires an external message generator. The particular message format employed cannot be generated by actuation of the meter keyboard.

Preferably the serial number message format includes one digit as an operational indicator. If the serial number has been entered and the operational indicator is set to zero, the serial number in the random access memory of the meter will be changed to the value contained in the data message. If the operational indicator is set to a one, the firmware will cause the meter to operate to examine the serial number presently contained in the random access memory image of of non-volatile memory and compare

it with the value contained in the serial number message. If the result is favorable or true, the program will set the non-volatile memory lock bit image in the random access memory thus preventing further access into this program once the image is written into the meter's non-volatile memory.

It should be recognized and understood that as used herein the terms postage meter and postal meter refer to the general definition of a device for the imprinting of a defined unit value for governmental or private carrier, delivery such as parcels or envelopes or other like application for unit value printing. Thus, the term postage meter is utilized as it is both known and employed in the trade, as a general term for devices utilized in conjunction with services other than those exlcusively provided by governmental postal services. For example, private parcel or freight services purchase and employ postal meters as a means to provide unit value printing for and such meters include accounting and printing functions.

While the present invention has been disclosed and described with reference to a single embodiment thereof, it will be apparent that the variations and modifications may be made therein, and it is intended in the following claims to cover each such variation and modification as falls within the true scope of the invention.

Claims:

1. A postage meter (2) characterized by:

printing means (128) for printing postage;

a computing means (26) coupled to said printing means (128) for accounting for postage printed by said printing means (128);

non-volatile memory means (30) coupled to said computing means (26) and

a program store (28) coupled to said computing means and adapted to store programs to control the operation of said computing means (26), said program store (28) containing a program operable to cause said computing means (26) to compare a serial number message including an operational indicator bit (46) entered into the postage meter with a previously entered postage meter serial number and operable to cause said means to set a lock bit preventing reentry into said program if a comparision is obtained in the condition where an operational indicator bit in said entered serial number message is set to indicate a desire to utilize the entered serial number.

2. A postage meter as claimed in claim 1, characterized in that said program store (28) contains a program arranged to cause the postage meter (2) to generate a fatal error message which will lock the postage meter in an inoperative condition if a serial number message is entered into the postage meter and said lock bit has been previously set.

3. A postage meter as defined in Claim 1 or 2, characterized by an external communicatcns port (16) coupled to said computing means (26) and adapted to interact with an external message generator (20) adapted to generate a serial

number message.

4. A postage meter as claimed in any one of claims 1 to 3, characterized by a keyboard (10) coupled to said computing means (26), said serial number message format being of a type which is not generateable from said keyboard (10).

5. A postage meter as claimed in any one of claims 1 to 4 characterized by a volatile, random access memory (34) coupled to said computing means (26), said program in said program store being arranged to cause serial number and lock bit data manipulations to be stored initially in said volatile, random access memory (34) and to be written into said non-volatile memory (30) upon the actuation of a switch coupled to said computing means (26).

6. A postage meter as claimed in claim 5 characterized in that said switch is a power switch (15).

7. A postage meter as claimed in claim 5 characterized in that said switch is a service mode switch (12).

8. A postage meter as claimed in any one of the preceding claims wherein said computing means is a microprocessor (26).

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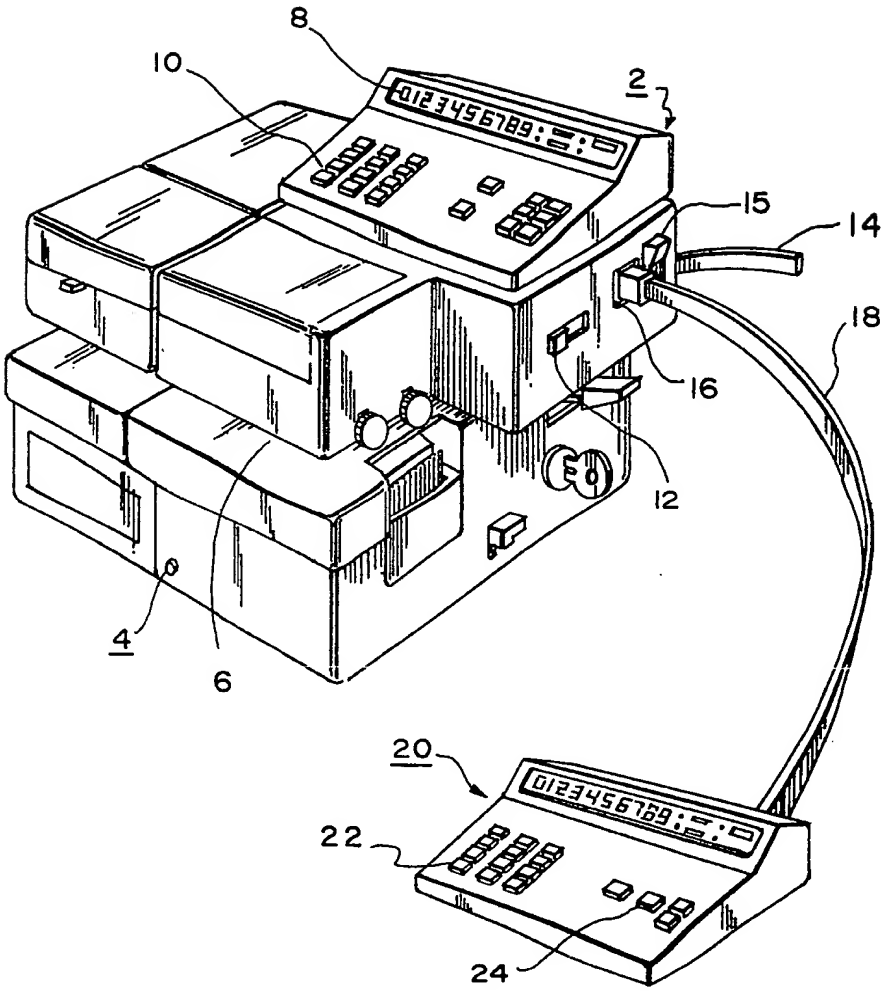


FIG. 1

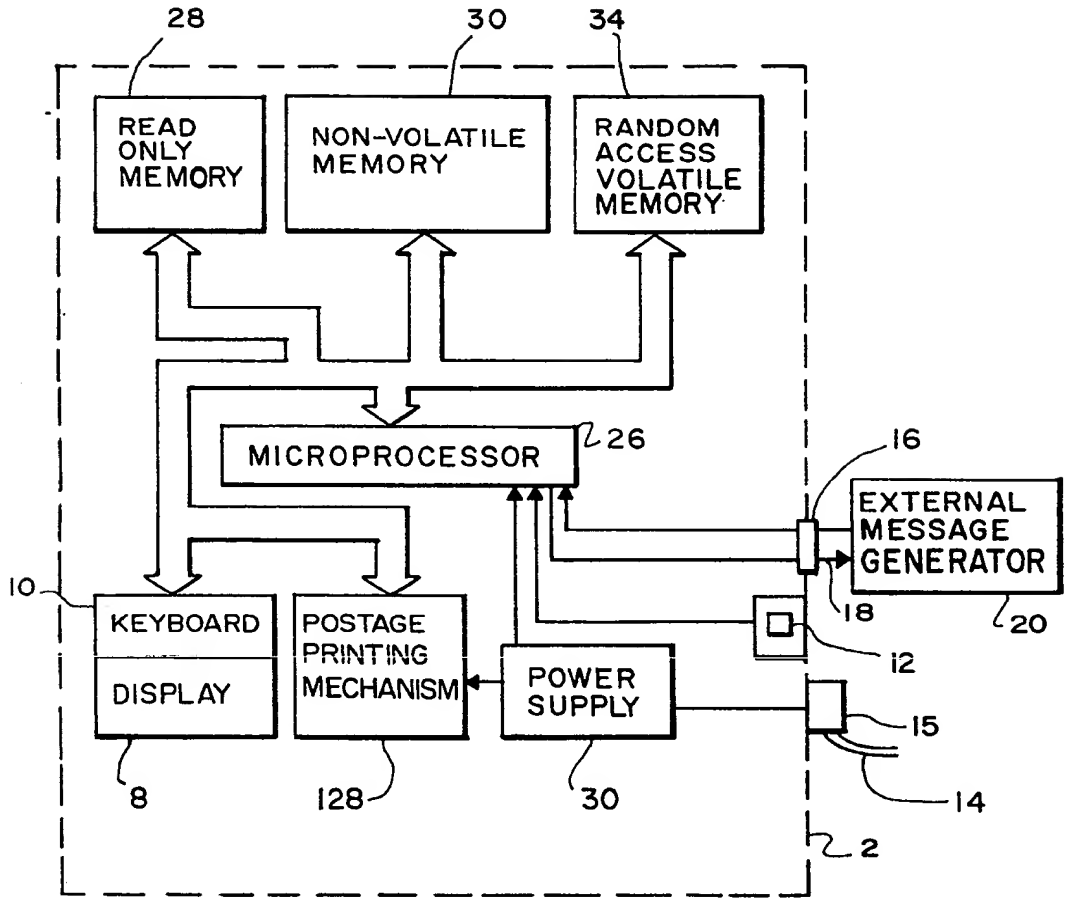

28
30
34
READ ONLY MEMORY
NON-VOLATILE MEMORY
RANDOM ACCESS VOLATILE MEMORY
MICROPROCESSOR
26
16
EXTERNAL MESSAGE GENERATOR
20
18
12
10
KEYBOARD
DISPLAY
POSTAGE PRINTING MECHANISM
POWER SUPPLY
15
14
8
128
30
2

FIG. 2

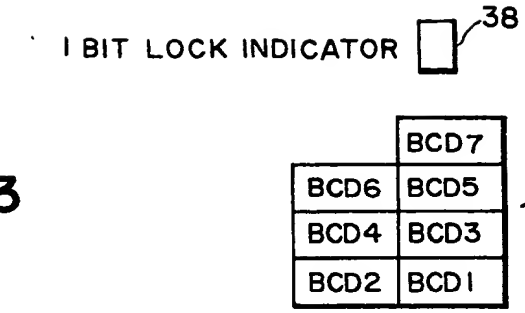


FIG. 3

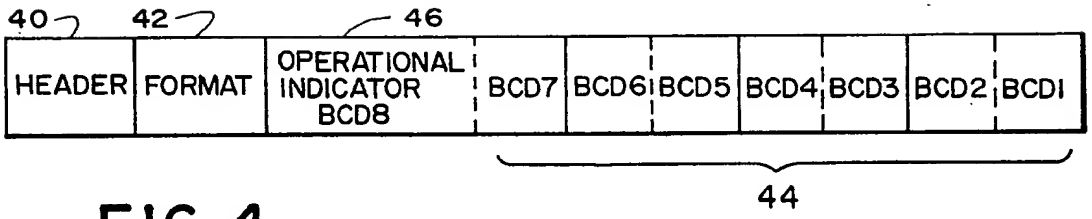


FIG. 4

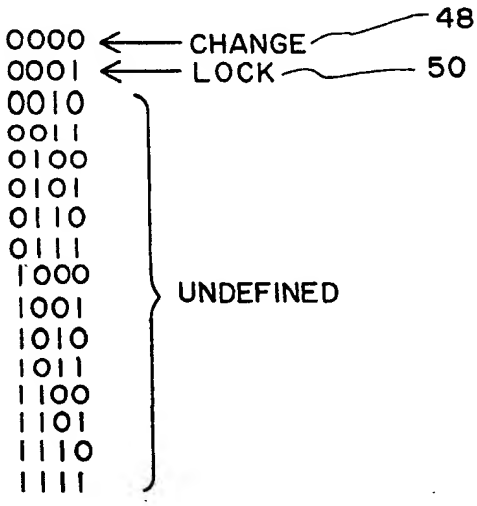
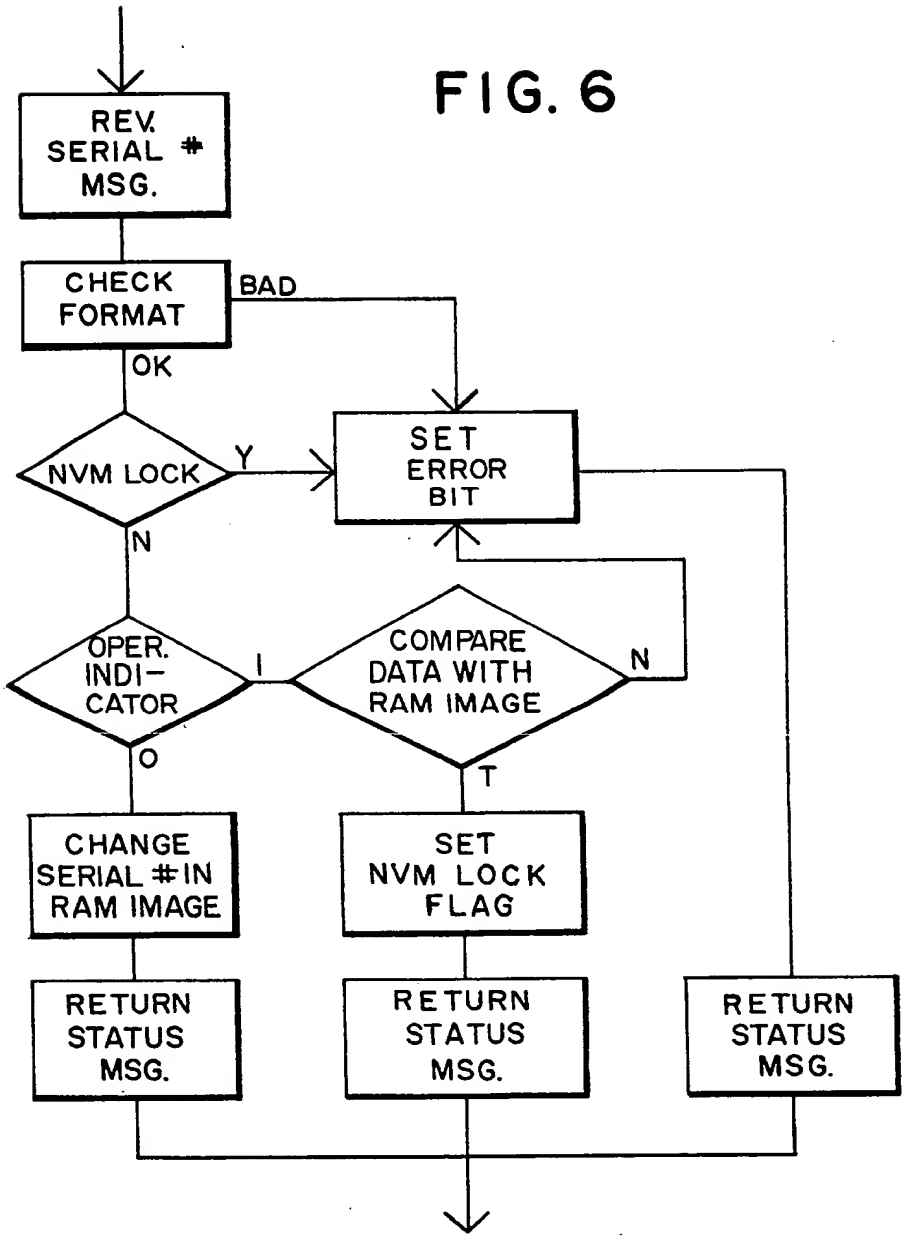


FIG. 5

FIG. 6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O
T
CHANGE SERIAL # IN RAM IMAGE
SET NVM LOCK FLAG
RETURN STATUS MSG.
RETURN STATUS MSG.
RETURN STATUS MSG.